ENERGY SAVINGS PROGRAM FOR BEVERAGE VENDING MACHINES

Local Energy Efficiency Program Proposal

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Submitted in Response to:

California Public Utilities Commission
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Submitted by:

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1. PROGRAM OVERVIEW

ADM Associates, Inc. (ADM) is proposing to implement an Energy Savings Program for Beverage Vending Machines as a Local Nonresidential Energy Efficiency Program for Program Years 2002 and 2003. This program that we are proposing is a continuation and extension of a similar program that ADM implemented as a Third Party Initiative for Southern California Edison Company (SCE) during 2001.

1.1 BRIEF DESCRIPTION OF PROGRAM

Our goal for the Energy Savings Program for Beverage Vending Machines is to install control devices (e.g., VendingMisers™ or programmable electronic cyclers, as appropriate) on vending machines in the following areas:

- Selected areas in PG&E's service territory that receive electricity from PG&E
- Selected areas in southern California that receive electricity from SCE
- SDG&E's service territory

The funding for the program is from electric public goods charges.

Through our proposed Energy Savings Program for Beverage Vending Machines, we install control devices (e.g., weekly programmable electronic cycling units, VendingMisers™) on vending machines to control the amount of time that the machines operate.

- There are some beverage vending machines that are located in spaces that are not accessible some hours of the day (e.g., in businesses that close for the evening). Such vending machines can be controlled by weekly programmable electronic cyclers that turn the machines off during hours when they will not be used.
- There are other machines that are in spaces that are always accessible for the convenience of potential users. In such circumstances, the vending machines can be controlled by the VendingMiser™. This device, which is manufactured by Bayview Technologies, uses a passive infrared (PIR) sensor to power down a vending machine completely when the area surrounding the machine is unoccupied. Once the vending machine is powered down, VendingMiser™ monitors the room's temperature. Using this information, VendingMiser™ automatically re-powers the vending machine at one- to three- hour intervals, independent of occupancy, to ensure that the vended product stays cold. VendingMiser™ is a simple external plug-and-play product; it typically can be installed without interrupting a customer's operations.

For some vending machines, we may also recommend having the machine owner remove the lighting (where appropriate). The average beverage vending machine uses two high-output fluorescent bulbs, which light nearly the entire front of the machine. Depending on the lighting configuration and counting the electricity used for the ballast, a beverage vending machine may use from 2 to 4 kWh of electricity per day just for lighting. Thus, removing the lighting from a vending machine may save from 730 to 1,460 kWh per machine per year. Because lighting is used to advertise the machine, we work with facility operators and machine owners to determine what machines can have their lighting removed.

1.2 PROGRAM RATIONALE

Typical cold-drink beverage vending machines have a peak load of 700 to 1,200 watts, using electricity not only for refrigerating the beverages but also for lighting. All of these machines are normally left running 24 hours per day, using from 7 to 12 kWh of electricity per day. In aggregate, the electricity use of beverage vending machines is significant. The California Energy Commission has estimated that beverage vending machines in California use 1.889 billion kWh per year.

Some effort has begun to reduce the electricity used by vending machines. In California, the California Energy Commission has begun the process of establishing a standard that will reduce the amount of lighting used by vending machines. Programs to reduce vending machine energy use have been put in place by several utilities in other parts of the U.S. For example, several utilities (e.g., BPA, Avista Utilities, Snohomish PUD) have evaluated the VendingMiser™ and have chosen to subsidize part or even all of the device's cost for its customers. Moreover, as noted above, ADM implemented a program to install control devices on beverage vending machines as a Third Party Initiative for Southern California Edison Company (SCE) during 2001.

These programs are based on the observation that vending machines do not need to operate continuously. Energy savings can be achieved by turning the machines off completely in hours when it is unlikely that they will be used or by cycling them off and on. Even when the vending machines are turned off overnight, the drinks stay sufficiently cold.

The major market barrier to reducing the electricity use of existing installed beverage vending machines is that the issue of split incentives is at work. Neither the machine owner nor the vendor/distributor of the products in the machine pays the energy bill for lighting and cooling the machine; the energy bill is paid by the owner or operator of the facility in which the machine is installed. Consequently,

there is no financial incentive for the machine owner or the product vendor/distributor to make the machines energy efficient. Indeed, although the energy use for new refrigerators has been reduced by at least 60 percent over the last twenty years, the same has not been true for vending machines. In fact, a vending machine uses more energy than the least efficient refrigerator.

The core concept for our proposed Energy Savings Program for Beverage Vending Machines (i.e., to directly install control devices on beverage vending machines) contrasts with the approach proposed by the utilities in their Statewide Nonresidential Express Efficiency rebates program. The utilities propose to offer rebates of $15 per unit for the installation of control devices on vending machines. However, this rebate is a relatively small percentage of the total cost of purchasing and installing a controller (i.e., about $200). Moreover, the utilties project little market penetration of vending machine control devices will result from this rebate. The numbers of controller installations projected by the utilities are 10 for SCE, 200 for SDG&E, and none for PG&E. By contrast, under our Third Party Initiative Program with SCE during 2001, we have already installed about 3,400 control devices on beverage vending machines in SCE's service territory. As will be shown below, the direct installation of the control devices as we propose is highly cost effective because of the magnitude of the savings that are realized.

1.3 PROGRAM OBJECTIVES

The number of vending machxines we control with different devices in each area and the aggregate savings that are expected are shown in Table 1-1.

Table 1-1. Expected Program Savings by Control Strategy, Program Year and Area

Area	***PY 2002***				***PY 2003***				***Totals***
	PG&E	***SCE***	***SDG&E***	***Subtotal***	***PG&E***	***SCE***	***SDG&E***	***Subtotal***	
					Vending Misers				
Number of machines controlled	1,000	700	300	2,000	2,000	500	400	2,900	4,900
Total savings (MWh)	1,818.0	1,272.6	545.6	3,636.0	3,636.0	909.0	727.2	5,272.2	8,908.2
Total demand savings (kW)	39.0	27.3	11.7	78.0	78.0	19.5	15.6	113.1	191.1
					Programmable Electronic Cyclers				
Number of machines controlled	1,000	700	300	2,000	1,500	500	300	2,300	4,300
Total savings (MWh)	2,052.0	1,436.4	615.6	4,104.0	3,078.0	1,026.0	615.6	4,719.6	8,823.6
Total demand savings (kW)	20.0	14.0	6.0	40.0	30.0	10.0	6.0	46.0	86.0

Table 1-2 provides summary information regarding other objectives of our proposed Energy Savings Program for Beverage Vending Machines.

Table 1-2. Proposal Summary for Energy Savings Program for Beverage Vending Machines

Program Name	Energy Savings Program for Beverage Vending Machines
Program Category	Local Nonresidential Programs
Budget	$1,790,058
TRC Ratio	3.03
PPT Ratio	5.26
Annual kWh Savings Target	17,731,800
Annual Peak kW Reduction Target	277.1
Annual Therm Savings Target	N/A
Other Performance Targets	9,200 Vending Machines
Program Strategies	Cycle cold drink vending machines off when no demand for product
Target Market Segments	Nonresidential

As shown by the summary data in Table 1-2 and by the rest of our proposal, the Energy Savings Program for Beverage Vending Machines satisfies various criteria that the CPUC has specified for local efficiency programs.

- It provides long-term annual savings in electricity by reducing the amount of electricity used by beverage vending machines on which control devices are installed.
- It is cost effective in the savings it provides per dollar of cost, with a TRC of 3.03 and a PPT of 5.26. (These tests are documented in Section 4 and in the accompany spreadsheet.)
- It addresses the split incentives that create a major market barrier for installing controllers to reduce the electricity use of beverage vending machines.
- It has equity considerations, in that beverage vending machines are often located in hard-to-reach small businesses. Providing the control devices for vending machines in such businesses directly reduces their electricity costs.
- It can provide peak demand savings to the extent that vending machines that are controlled do not operate during peak hours.
- It is innovative, addressing a market that heretofore has not received much attention in energy efficiency programs.
- It has synergies with other programs, in that we can use the occasion of installing the control devices to inform the businesses about other energy

efficiency opportunities available through other programs (e.g., Express Efficiency).

2. PROGRAM PROCESS

Our process for the proposed Energy Savings Program for Beverage Vending Machines builds directly on the process and procedures that we used over the past year in implementing a similar program in the service territory of Southern California Edison Company. We already have in place all of the personnel, equipment, and procedures needed to operate the Energy Savings Program for Beverage Vending Machines during PY 2002 and PY 2003.

Although we have procedures in place for implementing the Energy Savings Program for Beverage Vending Machines, we do need to coordinate our work with that of the utilities and other parties who have programs that may also involve controlling the electric use of vending machines. Accordingly, we prepare an implementation plan at the start of the program that specifies the process and procedures that we will be using to implement the program and to coordinate our work with that of others.

Our work effort for designing and implementing the Energy Savings Program for Beverage Vending Machines during PY 2002 and PY 2003 is divided among three (3) tasks.

- Task 1 is to market the program.
- Task 2 is to install VendingMisers™ or programmable electronic cyclers on vending machines at the recruited sites.
- Task 3 is to prepare a report assessing the impacts of the program.

The activities in each task are described in the following discussion.

2.1 TASK 1: MARKET PROGRAM

Task 1 is to market the Energy Savings Program for Beverage Vending Machines. The activities in this task include the following:

- Developing partnerships with Pepsi Cola, Coca Cola and other beverage distributors to facilitate the installation of vending machine controllers;
- Working with the distributors to identify the targeted customer group where the greatest saving can be achieved in locations such as schools and office buildings; and
- Preparing marketing plans and advertising and promotional materials.

Based on our work on the beverage vending machine for SCE, we have already established contacts with Pepsi Cola, Coca Cola and other major beverage distributors. Indeed, we have already worked with Coca-Cola Bottling in

Sacramento in performing extensive testing of different control devices. For Coca Cola and other distributors of name brand soft drinks, the quality of the product delivered is one of their biggest concerns.

The control strategies that we use with beverage vending machines must take into account the interests of beverage vendors and/or distributors and of the facilities where the vending machines are located. ADM is currently implementing a program for Southern California Edison to install control devices on beverage vending machines in SCE's service territory. As part of that effort, we have consulted with many soft drink vendors and/or distributors. In general, vendors express interest in participating in a program that reduces demand and saves energy for their customers. However, vendors do not want to miss sales, nor do they want to sell warm sodas. When a vending machine is turned off, the temperature in the interior of the machine will rise, as will the temperature of the beverage product. Indeed, Coca-Cola issues a special dial thermometer to their delivery personnel to check that their vending machines are maintaining beverage temperatures within an "ideal" temperature range for the product of 34 °F to 40 °F. It is unacceptable if the product temperature reaches 48 °F or above. Temperatures between 40 °F to 48 °F are acceptable, but are not desirable.

In working with Coca Cola and other distributors, we have also learned that some facilities have begun asking distributors to remove vending machines because the facilities are concerned about the amount of electricity being used. In approaching other distributors to participate in the program, we can point out that their participation in the program can be used to show facilities that the distributors are also concerned that the facilities not be paying too much for the electricity that they are using for keeping the vending machines.

The second activity in Task 1 is to identify the types of sites that are most suitable for the program. For this activity we work closely with beverage distributors to determine which facilities have machines that are best suited to receive the controllers. Our experience with the beverage vending machine program that we are implementing for SCE indicates that working one-to-one with distributors is the most effective approach for getting controllers installed in appropriate machines. Locations that will have highest priority for installation are expected to be facilities that have been identified as having the highest potential savings, which includes schools, colleges/universities, office buildings, and industrial and commercial facilities with break rooms.

As the third major activity in Task 1, we prepare informational and marketing material that we can use to market the program and recruit sites to participate. Information is provided that identifies the types of control strategies (i.e.,

programmable electronic cyclers), that explains the differences among strategies, and that highlights the advantages and limitations of each strategy. The information will include graphical presentation of energy use for the vending machine with and without the device. It will explain how the control device works and how savings are achieved. The informational material is a relatively straightforward presentation of the kWh and cost savings that can be achieved by installing a control device.

As a final aspect of our marketing, we promote the program door-to-door. We select areas that have facilities that have a high likelihood of having beverage vending machines. For these areas we send our installation teams door-to-door to market the program and install the control devices.

2.2 TASK 2: INSTALL VENDINGMISERS™ OR PROGRAMMABLE ELECTRONIC CYCLERS ON BEVERAGE VENDING MACHINES AT RECRUITED SITES

Task 2 is to install VendingMisers™ or programmable electronic cyclers on beverage vending machines at the sites that have been recruited to participate in the program.

Vending machines are basically refrigerators, cycling on and off to maintain a steady internal temperature. In addition, newer machines often have lights that operate continuously. A typical vending machine stocks 450 cans of cold drinks, has a peak load of 700 to 1,200 watts, and uses 7 to 12 kWh per day. The major energy-using components in a vending machine include the compressor, evaporator fan, lighting, and the vending/coin changer. Figure 2-1 shows the percentage distribution of a vending machine's electricity use according to these components. We would note that new vending machines now are equipped with electronic controls that allow them to be programmed to control compressor and lights (but not circulating fans). Machines in the future are expected to have capabilities to control all three.

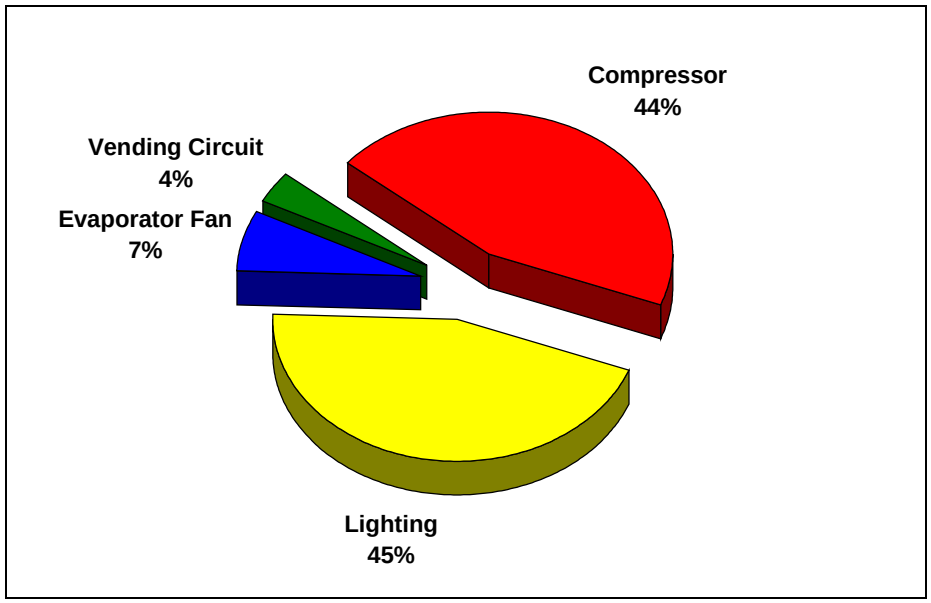

Figure 2-1. Percentage Distribution of Electricity Use by Component in a Typical Vending Machine

Only the first three components are candidates for control strategies, and even controlling the lighting may not always be an option. There are some type of locations and businesses that need to have the lighting continuously in operation. The decision to control a machine's lighting must be at the discretion of the vendor. Both electronic cyclers and VendingMisers™ turn lighting off when the compressor of a vending machine is off.

The change in the electric load profile of a vending machine when a VendingMiser™ is installed is shown in Figure 2-2.

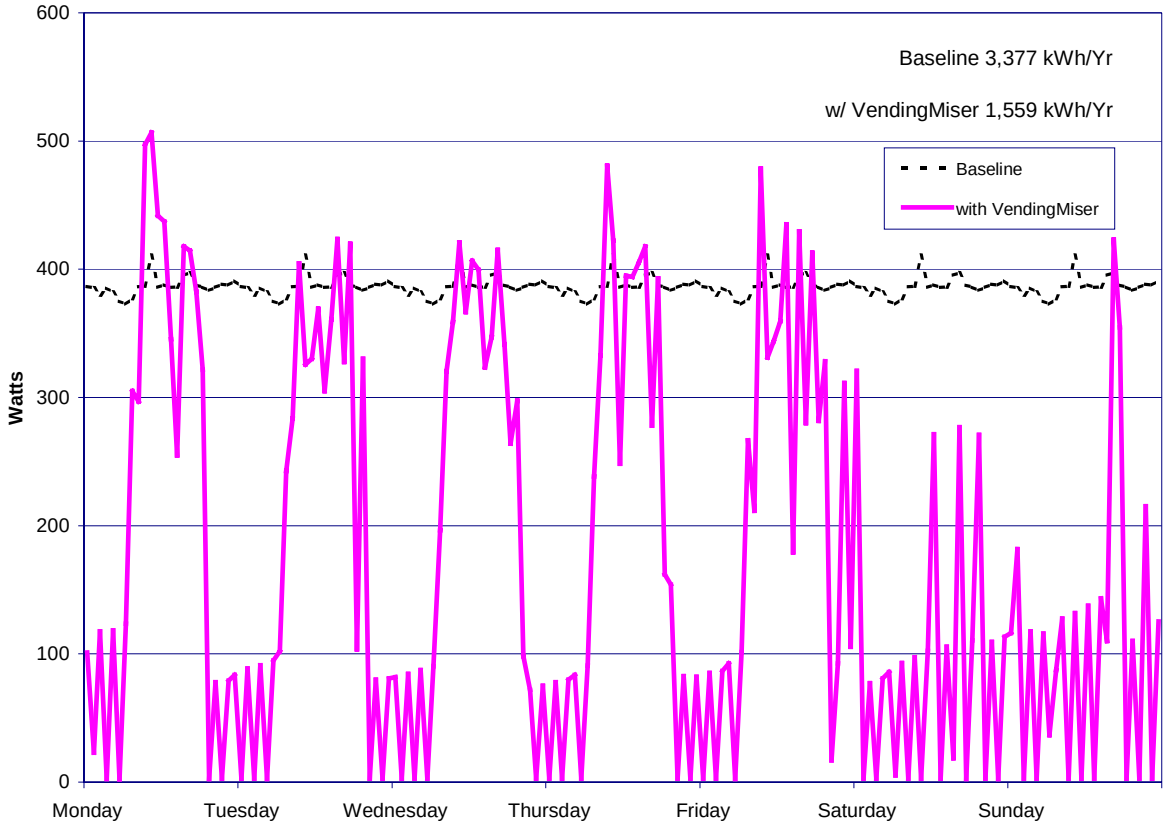

Figure 2-2. Weekly Load Profile for a Soda Vending Machine with and without VendingMiser™ Installed

For each facility where removal of lighting from the vending machines appears warranted, we provide the facility operator with a form that requests the owner(s) of the vending machines to remove the lighting. We attach this form to the vending machine(s) so that the lights can be removed at the next restocking of the machine(s). We expect that removing the lighting will be more acceptable for machines that are located inside a building. Vending machine owners generally do not want lights removed if the vending machines are located outside. They believe that the lighting attracts more customers to use the machines. However, the final decision on removal of any lights in the vending machines is made by the facility operator.

Each installation of a electronic cycler or VendingMiser is documented on a Controller Installation Form.

2.3 TASK 3: PREPARE REPORT ON PROGRAM

As Task 3, we prepare a report that documents our work on the Energy Savings Program for Beverage Vending Machines. The final report will include information about all activities undertaken as part of the program. The number of firms for which programmable electronic cyclers or VendingMisers were installed on vending machines is reported, as is the number of programmable electronic cyclers or VendingMisers installed. The energy and demand savings achieved with the program are demonstrated.

3. CUSTOMER ELIGIBILITY

Customers eligible for the Energy Savings Program for Beverage Vending Machines are those commercial or institutional facilities that have beverage vending machines. Such facilities include retail stores, offices, grocery stores, schools, colleges, and hotels/motels, among others.

The areas in which we propose to implement the Energy Savings Program for Beverage Vending Machines are depicted in Figure 3-1. These areas are in the service territories of PG&E, SCE, and SDG&E, excluding those areas that are served by municipal electric utilities. Within the service territories of PG&E and SCE, areas with higher density of beverage vending machines are targeted. The service territories of municipal electric utilities are not part of the target market for the program because customers in those territories do not pay the electric public goods charages that the program will be funded through.

Businesses with beverage vending machines can of course differ considerably in type, size, and financial resources. We accommodate these differences by using two types of control devices.

- There are some beverage vending machines that are located in spaces that are not accessible some hours of the day. Based on our work for SCE, these machines are often found in small service-type businesses (e.g., auto repair garages) that close for the evening. Such vending machines can be controlled by weekly programmable electronic cyclers that turn the machines off during hours when they will not be used.
- There are other machines that are in spaces that are always accessible for the convenience of potential users. In such circumstances, the vending machines can be controlled by the VendingMiser™.

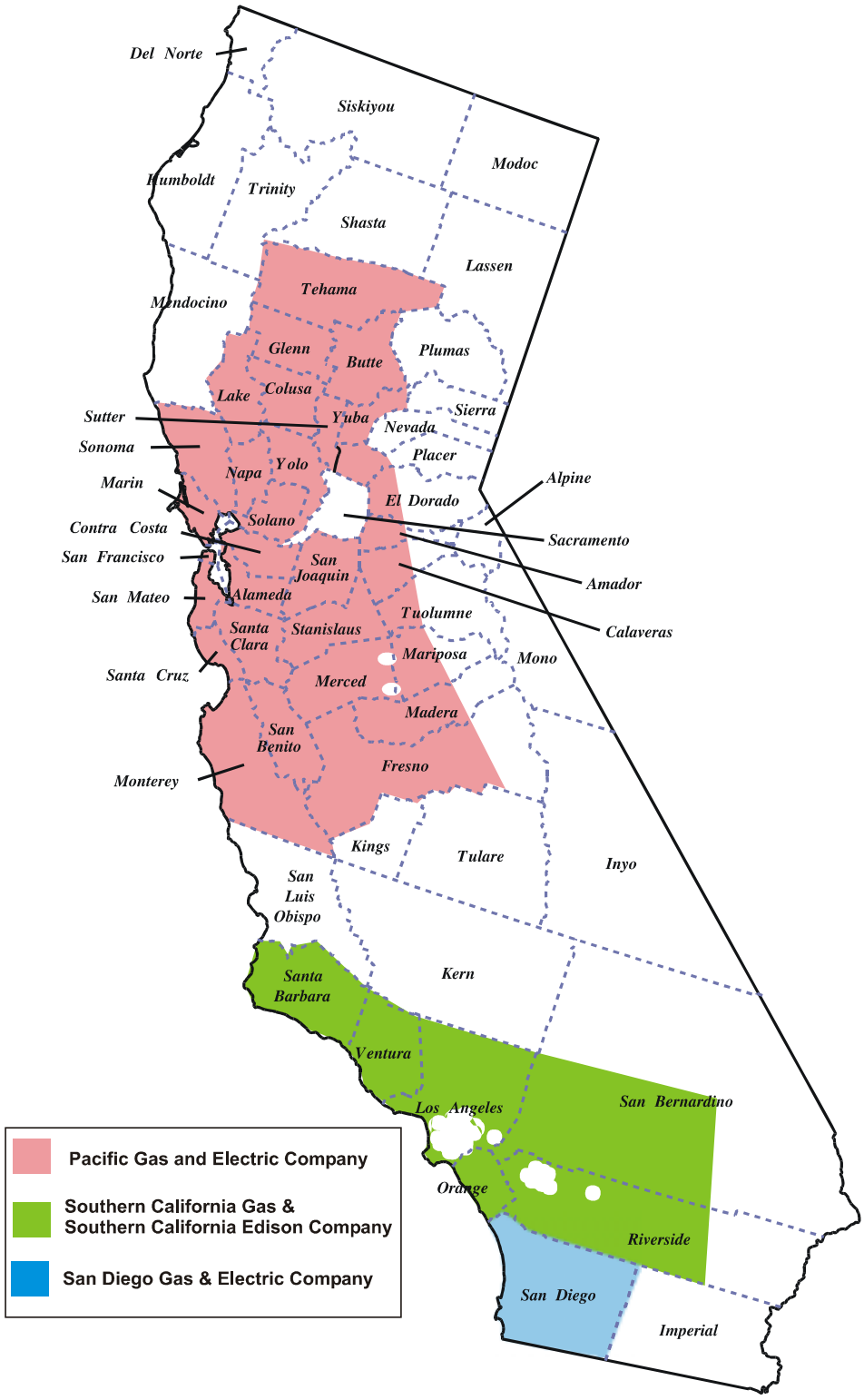

Figure 3-1. Areas in Which Energy Savings Program for Beverage Vending Machines Will be Implemented

4. COST EFFECTIVENESS CALCULATIONS

We have used the cost-effectiveness spreadsheet provided by the CPUC to calculate the cost-effectiveness of the Energy Savings Program for Beverage Vending Machines. The summary results from these calculations are reported in Table 4-1.

Table 4-1. Summary Results of Cost-Effectiveness Calculations for Energy Savings Program for Beverage Vending Machines

Test	***Costs***	***Benefits***	***Ratio***	***Net Benefits***
TRC test	$1,519,338	$4,609,513	3.304	$3,090,175
Participant test	$1,353,600	$7,115,491	5.257	$5,761,891

As described in Section 2, there are two different types of devices that can be used to control the energy use of beverage vending machines. Table 4-2 shows the number of vending machines to be controlled with different devices and the annual energy savings that result (both kWh and kW).

Table 4-2. Annual Energy and Cost Savings for Energy Savings Program for Beverage Vending Machines

Area	***PY 2002***				***PY 2003***				***Totals***
	PG&E	***SCE***	***SDG&E***	***Subtotal***	***PG&E***	***SCE***	***SDG&E***	***Subtotal***	
					Vending Misers				
Number of machines controlled	1,000	700	300	2,000	2,000	500	400	2,900	4,900
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Total demand savings (kW)	39.0	27.3	11.7	78.0	78.0	19.5	15.6	113.1	191.1
					Programmable Electronic Cyclers				
Number of machines controlled	1,000	700	300	2,000	1,500	500	300	2,300	4,300
Total savings (MWh)	2,052.0	1,436.4	615.6	4,104.0	3,078.0	1,026.0	615.6	4,719.6	8,823.6
Total demand savings (kW)	20.0	14.0	6.0	40.0	30.0	10.0	6.0	46.0	86.0

5. PROGRAM PERFORMANCE GOALS

Our performance goal for the Energy Savings Program for Beverage Vending Machines is to install VendingMisers™ or weekly programmable electronic cyclers (as appropriate) on beverage vending machines. The target numbers of vending machines for which each type of control device will be installed are shown in Table 5-1.

Table 5-1. Target Numbers of Vending Machines for Different Control Devices by Program Year and Utility Service Territory

Area	***PY 2002***				***PY 2003***				***Totals***
	PG&E	***SCE***	***SDG&E***	***Subtotal***	***PG&E***	***SCE***	***SDG&E***	***Subtotal***	
Number of machines controlled by VendingMiser	1,000	700	300	2,000	2,000	500	400	2,900	4,900
Number of machines controlled by electronic cyclers	1,000	700	300	2,000	1,500	500	300	2,300	4,300

6. EVALUATION, MEASUREMENT AND VERIFICATION PLANS

This section discusses our approach to performing the evaluation, measurement and verification work for the Energy Savings Program for Beverage Vending Machines and to reporting on program progress.

6.1 APPROACH TO EVALUATION, MEASUREMENT AND VERIFICATION

As part of the implementation plan that we prepare for the Energy Savings Program for Beverage Vending Machines, we prepare a plan for measuring and evaluating the program's effects, including the savings that result. Our preliminary outline of that plan is presented here. A more detailed plan would be prepared as part of the implemenation plan.

The evaluation of the program will include information about all activities undertaken as part of the program. We assess the number of vending machines controlled and the kWh savings that result from controlling these machines. We will have collected the information on the number of machines controlled during the course of the program, using the tracking system discussed in Section 6.2.

For a sample of the machines on which we install either electronic cyclers or VendingMisers™ we conduct monitoring to determine the savings being realized for these units. We prepare a sampling plan that specifies the types and number of vending machines to be monitored to provide the savings information. We conduct the monitoring using plug-in loggers to measure the on/off operation of the vending machines, from which we can estimate the change in operating hours of a machine as a result of its being controlled. The data collected through this monitoring allow us to calculate savings per machine that result because of a control device being installed.

As an example of how the data collected through the monitoring will be used, Figure 2-2 showed the effect that the VendingMiser™ has on the load profile of a beverage vending machine. (An actual machine was monitored over a week for a facility with a five-day period of operation.) Such load profile data allow us to calculate the actual energy use of a vending machine and how that energy use changes when a control device is installed. We generate load profiles similar to that in Figure 2-2 for all of the sites in the monitoring sample and calculate the resulting savings.

Together, the data on the number of machines being controlled and on the average savings per controlled machine (for different types of control devices) will allow us to develop estimates of the aggregate savings attributable to the program.

6.2 REPORTING REQUIREMENTS

Although we have procedures in place for implementing the Energy Savings Program for Beverage Vending Machines, we do need to coordinate our work with that of the utilities and other parties who have programs that may also involve controlling the electric use of vending machines. Accordingly, we prepare an implementation plan at the start of the program that specifies the process and procedures that we will be using to implement the program and to coordinate our work with that of others. We submit this plan to the CPUC and the CPUC-designated contract manager for review and approval.

From our work in implementing and evaluating energy efficiency programs, we know the importance of having good information in a program tracking system in order to track the progress of the program and to evaluate its effects. For the Energy Savings Program for Beverage Vending Machines, we already have in place the system for tracking the work, based on the work on a similar program that we have conducted as a Third Party Initiative for Southern California Edison over the past year. The system is up and running and will require little modification to tailor it to meet the data collection and reporting requirements involved in our implementing of the Energy Savings Program for Beverage Vending Machines.

Our tracking system includes all of the procedures, policies, protocols, forms, data entry and the data storage methods needed to meet the data collection and reporting requirements involved in our implementing this program. We track specific types of information that enable us to evaluate the progress of the program and our efforts. We use *Excel*™ and *Access*™ as the platforms on which we store the data for the program.

In particular, the Tracking System provides information on the following items:

- Total number of businesses contacted and recruited;
- Number of programmable electronic cyclers and/or VendingMisers installed at each facility;
- All available information on impacts of the program, including anecdotal feedback from market actors.

During the course of the program, we use the tracking system to prepare quarterly reports that detail the previous quarter's activities and progress towards meeting the goals of the program. Each quarterly report includes information on the number of sites contacted and the number of vending machines actually controlled.

7. DESCRIPTION OF ADM'S QUALIFICATIONS

This section identifies the personnel for the project and provides information on the qualifications and experience of ADM and its personnel.

7.1 ADM'S QUALIFICATIONS AND EXPERIENCE

ADM Associates, Inc., which began business in 1979, is a professional services corporation providing research and consulting services in applied energy engineering and economics to utilities nationwide. The services ADM provides primarily relate to analyzing energy usage and taking actions to save resources. ADM's headquarters are in Sacramento, California with regional offices in New York and southern California (Los Angeles). From these offices, ADM conducts energy-related studies and projects for a variety of utility companies, government agencies and other clients.

In proposing to implement the Energy Savings Program for Beverage Vending Machines, we draw on our hands-on experience in implementing a similar program for Southern California Edison during 2001. Under SCE's 2001 Third Party Initiative, we implemented a program to install control devices (i.e., electronic cyclers or VendingMisers™, as appropriate) on beverage vending machines in SCE's service territory. We have installed nearly 3,500 controllers on beverage vending machines through this program during the last half of 2001. From our experience in implementing this program for SCE, we have first-hand experience in working with beverage vendors/distributors in getting control devices installed on vending machines and have the infrastructure for implementing and administering such a program already in place. Because we are not a manufacturer or distributor of vending machines or vending machine products, we are able to work with distributors for various brands of beverages without raising any questions of conflicts of interest.

ADM also has considerable experience in designing, implementing and administering other energy efficiency programs. Following are brief descriptions of projects that illustrate the qualifications and experience of ADM for designing and implementing an energy efficiency program such as the Energy Savings Program for Beverage Vending Machines.

- **Upstream High-Efficiency Gas Water Heater Program**

  For: Southern California Gas

  ADM has been under contract to SoCalGas since 1999to implement an upstream high efficiency gas water heater program. The purpose of this program was to increase the sales of higher efficiency gas water heaters by working with manufacturers, wholesaler/distributors, water heater dealers, and

plumbing contractors throughout SoCalGas's service territory. Our work included meeting with the market actors, preparing point-of-purchase materials for retailers, and providing incentives.

- **Duct Efficiency Programs**

  For: Pacific Gas and Electric
  Southern California Edison
  Southern California Gas
  San Diego Gas and Electric

  Under the California Board for Energy Efficiency's third party program, ADM was under contract with the four major investor-owned utilities in California (i.e., Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric, and Southern California Gas) to implement residential duct efficiency programs throughout California. The Duct Efficiency Programs were aimed at institutionalizing good duct design and establishing retrofit duct repair as a component of HVAC maintenance. Through the Duct Efficiency Program, we provided HVAC and/or sheet metal contractors with the information, procedures, and technologies that they can use to market duct leakage inspection and repair services to residential single-family and multi-family houses. Through the program, contractors were educated and trained on how to provide duct inspection and repair services as a viable business venture. Contractors were taught new techniques and procedures that were explicitly designed under this program in order to be effective and not too expensive. Contractors who participated in the programs were also assisted in identifying households who were interested in having their duct system inspected and repaired.

- **Evaluation of 1993 Commercial Energy Management Hardware Rebate Program**

  For: Southern California Edison

  ADM conducted an evaluation of the savings achieved by customers who purchased equipment under Edison's 1993 Commercial Energy Management Hardware Rebate (EMHR) Program. We collected data on-site for a sample of 200 participants and used these data for DOE-2 analyses to develop estimates of the gross savings resulting from energy-efficient equipment installed through the EMHR program. The results of the analysis were also used to improve the algorithms internal to Edison's computerized *Book of Standards* (CBOS) and Measure Analysis and Recommendation System (MARS) programs.

- **Evaluation of Motors and Adjustable Speed Drives Programs**

  For: Northern States Power,

  For NSP, we conducted an evaluation of its *Motors and Adjustable Speed Drives Programs*. Through these programs, NSP provides rebates to commercial or industrial customers who install high efficiency motors or adjustable speed drives. As part of this evaluation effort, we conducted in-depth monitoring of the performance of the high efficiency motors and ASDs. We conducted monitoring at 50 sites where high efficiency motors had been installed and at another 50 sites where adjustable speed drives had been installed. A significant number of the sites where we monitored were ones where the motors or ASDs had been installed on HVAC equipment, either supply/return fans or chillers.

- **Commercial Audits Project**

  For: Entergy Services, Inc.

  For Entergy, we performed the Commercial Audits Project. We performed on-site audits at 650 commercial facilities throughout Entergy's service area. Using the data collected through these audits, we prepared customer-specific DOE-2 analyses of energy savings from conservation measures. We prepared audit reports for the individual customers and also aggregated the data to prepare system-level estimates of the saturations of various end-use technologies and DSM measures.

- **Commercial and Industrial Market Assessments Project**

  For: Northern States Power

  For Northern States Power, we were part of the team that conducted NSP's Commercial and Industrial Market Assessments Project. This study involved the development of a market analysis information system for the commercial and industrial sectors in NSP's service territory. We were responsible for collecting data on-site for a sample of 500 commercial and 250 industrial customers and preparing analyses of these data in support of the estimation of customer attitudes, market and technology profiles, and DSM technical and market potential. We made DOE-2 simulations for all 500 commercial facilities to determine their end-use energy use.

- **Evaluation of EMS Hardware Rebate Program**

  For: Southern California Edison Company

  In this study, ADM provided an engineering analysis of the savings resulting from HVAC or other DSM equipment that commercial customers installed in response to rebates from SCE. We collected data on-site for about 750

commercial customers and used these data in DOE-2 analyses to determine the energy savings associated with the rebate measures.

- **Evaluation of the Gas Cooling and Gas-Engine Drives Rebate Programs**

  For: Brooklyn Union Gas Company

  ADM performed process and impact evaluations of BU's Gas Cooling Rebate DSM program and Gas-Engine Drive Pilot Program. Both programs focused on commercializing new technologies (gas-fired absorption-cycle chillers smaller than 10-tons and all equipment larger than 100-tons are not eligible for BU's rebates). An interesting feature of the evaluations of these programs was that Consolidated Edison, the electric utility that serves the same customers, also offered a rebates for converting from electric-motor-driven equipment to gas-powered equipment. The impact evaluations (which were based on both a billing analysis and an SAE analysis of both gas and electricity billing records) took into account both electricity savings and gas-usage increases.

7.2 KEY PROGRAM PERSONNEL

This program requires expertise in market analysis and program design and implementation. Our team for this program provides these required capabilities.

- The principal point of contact between the CPUC's designated Contract Manager and the project team is ADM's project manager, Mr. Taghi Alereza. Mr. Alereza will provide overall technical leadership and will ensure that excellent staff support will be available to the project. He will direct the program design efforts and will be responsible for liaison with the Contract Manager.
- Market analysis and research and measurement and evaluation activities will be directed by Dr. Donald Dohrmann, who is director of economic studies at ADM.
- The day-to-day program manager will be Mr. Dan Mort, who is a Senior Project Manager at ADM.

Short biographical sketches for these and other key personnel for the project are provided in the following paragraphs. Full resumes are provided in Section 10, Attachments.

Taghi Alereza, P.E., who is President of ADM, will be the Principal-in-Charge of the work. Mr. Alereza is a nationally recognized expert in building energy simulation and modeling. He has pioneered the development of several state-of-the-art simulation procedures and models. Mr. Alereza has led ADM's effort to

develop and implement two statewide residential programs during the 1998 program year. He conceived and developed the "Residential Duct Efficiency Program," which was implemented in the service territories of Pacific Gas and Electric, Southern California Edison, Southern California Gas and San Diego Gas and Electric. Mr. Alereza also conceived the Local Energy Assistance Program (LEAP), which was implemented in the PG&E, SCE and SCG service areas. This program provided extensive training to developer/builders, local government staff and elected officials. He has directed program design and implementation including

- "Upstream High Efficiency Residential Water Heater Program" - implemented for Southern California Gas Co.
- "Refrigerated Vending Machine Cycling Program" - designed and implemented for Southern California Edison Co.
- "Performance Assurance Project" - designed and implemented simplified building commissioning project for Southern California Edison Co. and San Diego Gas and Electric Co.
- "Mobile Energy Clinic" – designed and implemented for Southern California Gas Co.
- "Lodging Industry Education And Audit Program" – designed and implemented for Southern California Gas Co.

Mr. Alereza holds a Bachelor of Mechanical Engineering degree from Auburn University and has completed an MS and the coursework for D.Sc. in mechanical engineering from the George Washington University. He is a member and past chairman of ASHRAE Technical Committee 9.6 (Energy Utilization), which is responsible for developing and applying protocols for assessing energy use in buildings, and the cognizant TC for the ASHRAE Standard 90.2. He is a registered professional engineer in California.

Dan Mort, is the Senior Program Manager at ADM, and will serve as the day-to-day program manager for the Vending Machine program. Mr. Mort has been managing the Vending Machine Cycling project that ADM is implementing for Southern California Edison Co. He was responsible for coordination with the vending and bottling companies, and for conducting evaluation of different strategies for reducing vending machine energy use. He has coordinated installation of vending machine cyclers and VendingMisers for 3,400 machines. Mr. Mort has also been responsible for residential lighting measurement and verification projects being conducted for Pacific Gas and Electric's Energy Saving Partners program for the past four years. He has managed several projects in the area of residential, commercial and industrial end-use energy use, and indoor air

quality, for several major utilities. Mr. Mort has a B.S. in physics from California State University, Sacramento.

Dr. Donald Dohrmann is a Principal of ADM Associates and Director of Economic Studies. He will be responsible for market analysis and measurement, evaluation, and verification for the program. Dr. Dohrmann has technical expertise in economics, survey design, and statistical analysis. He has developed and applied analytical methodologies for evaluating DSM programs, including evaluations of Portland General Electric's commercial new construction programs, Northern States Power's high efficiency motors and adjustable speed drives programs, Pacific Gas and Electric's Commercial New Construction Program and its Nonresidential Energy Management Services Programs. He has been responsible for designing the statistical sampling plans for surveys of residential, commercial and industrial firms that ADM has conducted for various companies, including Pacific Gas and Electric Company, Southern California Edison Company, the Bonneville Power Administration, Florida Power and Light, B.C. Hydro, Kansas City Power and Light, El Paso Electric, Southern California Edison Co., the Sacramento Municipal Utility District, San Diego Gas and Electric Co., and many other utilities. He has also been responsible for preparing and conducting the analysis of the data collected in these surveys. Dr. Dohrmann received his B. S. in economics from Iowa State University and his M. A. and Ph. D. in economics from Yale University.

Additional ADM field staff who will perform work on this project include:

- Steve Lee
- Hao Ly
- Ha Nguyen
- Van Thanh Nguyen
- Kenny Thai
- Khoi Tran
- Leon Tran

8. TIMELINE FOR PROGRAM IMPLEMENTATION

Our proposed timeline for implementing the Energy Savings Program for Beverage Vending Machines is shown in Table 8-1.

Table 8-1. Timeline for Implementing Energy Savings Program for Beverage Vending Machines

Activity	***Target Date***
Program Begins	5 Days After Contract Approval
Program Implementation Plan	3 Weeks After Project Start Date
Evaluation, Measurement & Verification Plan	5 Weeks After Contract Approval
First Quarter Report	3.5 Months After Contract Approval
Second Quarter Report	Quarterly
Third Quarter Report	Quarterly
Fourth Quarter Report	Quarterly
Fifth Quarter Report	Quarterly
Sixth Quarter Report	Quarterly
Program Completion	December 2003

9. PROGRAM COST PROPOSAL

Our cost proposal for the Energy Savings Program for Beverage Vending Machines is detailed in Table 9-1.

Table 9-1. Budget Summary

Item	First Year Cost	Second Year Cost	Total Cost
Administrative Costs			
Labor	$ 87,000.00	$ 130,500.00	$ 217,500.00
Benefits			$ -
Overhead			$ -
Travel costs	$ 6,000.00	$ 9,000.00	$ 15,000.00
Reporting costs		$ -	$ -
Materials & Handling	$ 8,800.00	$ 13,200.00	$ 22,000.00
General and Administrative costs	$ 29,544.00	$ 44,316.00	$ 73,860.00
Subcontractor costs (include same line items)			$ -
IOU Administrative Fee (only for non-IOU programs)	$ 33,639.20	$ 50,458.80	$ 84,098.00
Direct Implementation Costs			
Itemized (may be estimated)			
• VendingMeisers - 4,900 units @ $192 / unit	$ 384,000.00	$ 556,800.00	$ 940,800.00
• Electric Cyclers - 4,300 units @ $96 / unit	$ 192,000.00	$ 220,800.00	$ 412,800.00
Evaluation, Measurement and Verification Costs			
Direct labor		$ 24,000.00	$ 24,000.00
Other direct costs	$ -	$ -	$ -
Other Costs			
TOTAL BUDGET	$ 740,983.20	$ 1,049,074.80	$ 1,790,058.00

The budget allocation by program year and utility service territory is shown in Table 9-2.

Table 9-2. Budget Allocation by Utility Service Territory

Utility Service Territory	*PY 2002*	*PY 2003*	*Total*
Pacific Gas & Electric	$370,492.00	$ 712,335.00	$1,082,827.00
Southern California Edison	$259,344.00	$ 194,273.00	$ 453,617.00
San Diego Gas and Electric	$111,147.20	$ 142,466.80	$ 253,614.00
Total	$740,983.20	$1,049,074.80	$1,790,058.00

Our proposed payment schedule is shown in Table 9-3.

Table 9-3. Proposed Payment Schedule

#	***Event***	***% Payment***
1	Acceptance Of Final Program Implementation Plan	25%
2	Acceptance Of Evaluation, Measurement And Verification Plan	10%
3	Acceptance Of Quarterly Reports (Payments To Be Determined Proportional To The Number Of Implementations Performed)	50%
4	Final Payment Based On Evaluation, Measurement And Verification Results	15%

10. ATTACHMENTS

SODA MACHINE CONTROLLER INSTALLATION FORM

Soda Machine Controller Installation Form

Site ID _____

Site Name _____

Address _____

City _____

Contact Person _____ Phone _____

Engineer _____ Date _____

Quantity	Vending Miser	Timer	Lights Off	Amp Rating	Amp Rating
Soda Machine 1					

Timer Schedule	Turns On	Turns Off	Turns On	Turns Off
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday				

Quantity of Machines with "Disconnect Lamp and Ballast Notices" attached.

Location Description _____

Taghi Alereza
Principal & Director of Engineering

Mr. Alereza, a Principal of ADM Associates, Inc. and Director of the Engineering Division, is a recognized expert in energy analysis, energy modeling, energy forecasting, and system evaluation. He has been responsible for the development of several state-of-the-art contributions in the energy modeling field. These contributions have centered on energy analysis and energy forecasting for the residential, commercial, and industrial sectors. During his 25 years of professional experience, Mr. Alereza has successfully managed highly technical projects for over thirty major utility companies, the Department of Energy, California Energy Commission, and Electric Power Research Institute.

California Statewide Programs

Mr. Alereza has led ADM's effort to develop and implement two statewide residential programs during the 1998 program year. He conceived and developed the "Residential Duct Efficiency Program," which was implemented in the service territories of Pacific Gas and Electric, Southern California Edison, Southern California Gas and San Diego Gas and Electric. Mr. Alereza directed the development of the procedures for duct leakage tests and repairs, the training curriculum for HVAC contractors, marketing materials and program evaluation protocols. The Duct Repair program is being considered as an item with the most amount of incentives in the 1999 residential SPC program. Mr. Alereza also conceived the Local Energy Assistance Program (LEAP), which was implemented in the PG&E, SCE and SCG service areas. This program provided extensive training to developer/builders, local government staff and elected officials.

Program Evaluation

Mr. Alereza has managed several commercial, industrial and residential impact evaluations for Detroit Edison, Portland General Electric, Pacific Gas and Electric, Delmarva Power, BC Hydro, and Consumers Power Company. ADM designed the sample for participants and non-participants, collected the data, prepared baseline simulations of HVAC energy use, evaluated the energy impacts of the programs, and conducted all metering-related work, including installing, maintaining and removing metering equipment, collecting and verifying metered data on energy use and using these data to calibrate procedures for simulating such energy use.

Mr. Alereza has also managed various new construction evaluations for Pacific Gas and Electric, San Diego Gas and Electric, Southern California Edison Company and BC Hydro. ADM assessed the actual (realized) impact of several post-implementation program parameters, first-year annual energy savings, load shape impacts, net-to-gross and persistence impacts, incremental customer equipment and installation costs, and total customers' costs.

Pacific Gas and Electric's Commercial New Construction Program entailed an evaluation of realized savings for participant and non-participants using data on building equipment and characteristics; economic and attitudinal characteristics of the businesses involved; and billing and/or end-use metered data. In addition, monitoring equipment was installed in a subsample of the buildings to measure end-use electricity under "as operated" conditions.

ADM Associates provided analysis of the impacts of SDG&E, SCE and BC Hydro's energy efficiency programs. We conducted more than 300 high-resolution on-site surveys and correlated the results to billing data and local weather data. SDG&E and SCE's evaluations included additional parametric runs compared the energy use of the buildings under Title 24 conditions, as-built conditions and per incentivized measures. The data from the decision makers' survey was combined with the results of the DOE-2 parametric analysis to perform the overall net-to-gross analysis.

End Use Metering

Mr. Alereza has been the principal-in-charge on monitoring projects that collected data from more than 500 buildings in various locations.

He is currently managing Phase I and Phase II of an end-use metering project for Entergy Services Inc. ADM is performing this project to provide baseline end-use information for commercial buildings in Entergy's service area. We are installing monitoring equipment at 40 commercial buildings throughout Entergy's four-state service area and will be collecting end-use data from these buildings over the next year. End uses being monitored include space heating, air conditioning, and lighting, as well as end uses important in particular types of buildings (e.g., refrigeration in grocery stores).

As part of Pacific Gas & Electric Company's Collaborative Process program verification efforts, ADM conducted short-term monitoring of end uses in commercial and industrial buildings, both before and after conservation measure implementation. Data were analyzed to identify actual energy savings associated with each end use at each site and included in a comprehensive summary report prepared for each site. For Southern California Edison, ADM provided technical support for end-use metering of 50 commercial buildings. For San Diego Gas & Electric Company, ADM conducted its commercial end use and thermal storage monitoring project. We installed data acquisition systems at over 100 selected buildings with chillers and/or thermal storage systems in SDG&E's service territory. For all projects, ADM was responsible for recruiting the buildings for the program, preparing the meter installation plan, verifying the meter installation, and for validating the end-use data collected. Data validation is accomplished using our Load Profile Viewer, a custom-designed software program for reviewing and validating end-use load profile data. Installed equipment included current transformers, Btu meters, flow meters and temperature sensors.

He was responsible for the development of Data Analysis and Reporting System (DARS), a microcomputer software package that graphically displays metered end-use load data. DARS was developed as a coordinated set of SAS (Statistical Analysis System) programs that can extract end use load data from a mainframe data base and prepare the data for analysis and reporting. For simple reporting purposes, DARS can produce daily load profile plots, percent energy distribution pie charts, and energy distribution bar charts. For data analysis, DARS can produce load profile plots for various options, including individual site plots, plots for distributions across monitored sites, and plots for weighted averages across sites.

Industrial End-Use Data Analysis

Mr. Alereza managed two major industrial data collection and DSM evaluation projects for Bonneville Power Administration and Wisconsin Electric Power Company. The BPA project included development of a comprehensive database of available industrial DSM measures and their impact on industrial energy use by end-use. The WEPCO project included development of data collection procedures and collection of detailed industrial end-use inventory for 150 industrial facilities in Wisconsin. Also included in this project is a detailed analysis of end-use and process energy use and development of an industrial end-use analysis model.

Commercial Building End-Use Energy Data Collection and Analysis

For the past 15 years, Mr. Alereza has been responsible for data collection and analysis of several thousand commercial facilities throughout the United States. He has managed two major data collection and analysis projects on non-residential buildings for the Bonneville Power Administration. He has managed similar projects for many utilities including Pacific Gas & Electric Company, Southern California Edison Company, San Diego Gas & Electric Company, Florida Power & Light, Alabama Power, Rochester Gas & Electric Company and Union Electric. He has also been responsible for the development of several analysis models being used by many researchers.

Simplified Calculation Method (SCM)

Mr. Alereza developed the Simplified Calculation Method (SCM) which is the commercial building energy standard compliance tool for the California Energy Commission. The concept used in SCM was based on the variable-based degree-day method which was originally developed by Mr. Alereza for the National Bureau of Standards. The SCM provides capabilities for analysis of daylighting, evaporative coolers, and solar water heaters.

Building Energy Use Determination

Mr. Alereza was the program manager on a program which resulted in the development of a methodology for determining energy use in residential and commercial buildings in the U.S. Army facilities. This methodology employs

non-computerized procedures and renders computer approach accuracy without the cost and the effort involved in the computer simulation. He was a major contributor to a program which evaluated the correlation between building component structure and energy consumption in new and old residential buildings in the Baltimore/Washington area in 1972. The analysis techniques and concepts developed in this program were expanded and served as a basis for a similar evaluation of single- and multi-family housing in 10 geographic regions of the United States. Mr. Alereza was the principal investigator on this program, and his responsibilities included the technical direction of tasks which defined typical buildings for each location, determined their energy consumption patterns, and evaluated the energy savings that could be achieved through selected structural modifications.

Building Infiltration Measurement and Modeling

Mr. Alereza had participated in several outdoor air infiltration and ventilation studies. He modified and extensively used the infiltration model developed by the National Research Council of Canada to develop a simplified hourly infiltration model. He also developed another air infiltration model which calculates the outside air infiltration into residential buildings as a function of the building characteristics, wind velocity, and indoor/outdoor temperature differential. The parameters for this model were evaluated by using SF6 Tracer gas decay rates in residences in Baltimore, Chicago, Denver, St. Louis, and Washington, D.C. Later, this model was used to assess the indoor air quality as a function of outdoor air quality and the air change rate.

Commercial Electricity Demand Forecasting

Mr. Alereza was the program manager and a key technical contributor for a project which resulted in the development of an electricity energy use and demand forecasting model for the California commercial sector. Also included in this project was an inventory of physical and energy use characteristics of existing buildings and end-use devices in the commercial sector. This inventory was obtained through three phases of data acquisition: a mail survey, an on-site inventory survey, and spot metering of end-use devices.

Energy Use Patterns Analysis

Mr. Alereza provided technical support in the development of a comprehensive methodology for analyzing energy use patterns for conservation potential at the community level, an evaluation of the impact of time-of-day price structures on commercial and industrial sectors, the development of a regional commercial sector energy forecasting model, evaluation of hot water energy use in hospitals, and an assessment of energy use and energy conservation potentials in public buildings.

Solar Energy Driven Rankine Cycle Engines

Mr. Alereza has also been active in the solar energy field. He was a key contributor to a program which assessed the feasibility of utilizing Rankine cycle engines and absorption cycle equipment for the cooling of buildings. He contributed to nearly every phase of the study which addressed working fluids, solar collectors, and heat sinks as well as a comparative evaluation of the Solar Rankine Cycle, Solar Assisted Rankine Cycle, and Solar Absorption cooling concepts.

Publications

Mr. Alereza has authored over twenty research papers which he has presented to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). He has also served as the technical committee (TC) chairman on energy utilization. This committee is the cognizant TC for development of measurement and verification protocols being developed jointly by DOE and ASHRAE. He is the author of, or a principle contributor to, over 50 technical papers or major reports in the areas of energy analysis, energy conservation, and energy forecasting.

Some of the projects to which Mr. Alereza has been a principal technical contributor include:

- Conducting Survey of 500 Commercial Establishments in California, California Energy Commission
- Conducting Survey and Performing EUI Calculations for 60 Commercial Buildings, Southern California
- Conducting Survey of 400 Commercial Buildings in Baltimore, MD, Federal Energy Administration
- Development of Typical Commercial Buildings in California, California Energy Commission
- Development of Building Energy Standards for Residential and Commercial Buildings, State of Alaska
- Development of Non-Computerized Methodology for Building Energy Analysis, U.S. Army Construction Engineering Research Laboratory
- Evaluation of Residential Energy Consumption and Assessment of Technical Innovations Enabling Reduction of Energy Consumption, U.S Department of Housing and Urban Development
- Development of Variable-Based Degree-Day Energy Calculation Method, National Bureau of Standards
- Energy Use and Electricity Demand Forecasting for the Commercial Sector, Electric Power Research Institute
- Comprehensive Community Planning for Energy Management and Conservation, U.S. Energy Research and Development Administration
- Energy Analysis for the South Florida Region, South Florida Regional Planning Council

- Hot Water Usage in Hospitals, Lawrence Berkeley Laboratory

Prior to forming ADM Associates, Inc., Mr. Alereza was Program Manager of the Western Office of Hittman Associates, Inc.

Mr. Alereza is a graduate from Auburn University with a Bachelor of Mechanical Engineering (B.M.E.), and has completed M.S. and the coursework for a D.Sc. in Mechanical Engineering at George Washington University. Mr. Alereza is a Registered Professional Engineer in the State of California.

Donald R. Dohrmann, Ph.D.
Principal & Director of Economics Studies

Dr. Dohrmann, a Principal of ADM Associates and Director of the Economics Studies Division, has 25 years of business and academic experience in economic analysis, survey design, and statistical analysis. He has also been responsible for evaluating the economic viability of new energy conservation technologies and preparing forecasts of the commercial acceptance of these technologies. He has considerable experience in designing studies to collect data on energy use by commercial firms and households, in analyzing the economic factors affecting the choice of energy-using technologies for commercial, industrial and residential buildings, and in forecasting the acceptance of conservation measures for such buildings. He has been the Principal Investigator on several studies that involved designing and executing surveys to collect data on the factors affecting energy use by commercial firms and households. He has been a primary contributor to the development of end-use demand forecasting models for the commercial sector.

Survey Design

Dr. Dohrmann's experience in designing surveys includes:

- For the Bonneville Power Administration, he was the Principal Investigator on a study in which a survey was conducted to collect data on the prices and energy efficiencies on residential appliances. The data collected were formatted into a database for BPA's use in formulating programs to encourage households to choose energy efficient appliances.
- For the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), he has been the pricipal investigator on two research projects to conduct nationwide surveys to collect and analyze data on the maintenance costs of HVAC equipment.
- For the Electric Power Research Institute, he was the Principal Investigator for a study that evaluated sample survey techniques for collecting end-use data on commercial customers of electric utilities.
- For the Pacific Gas and Electric Company, he prepared the sampling plan for conducting an on-site survey of 675 of PG&E's commercial customers.
- For the California Energy Commission, he evaluated and prepared sampling plans for conducting on-site surveys of nearly 900 commercial customers of Pacific Gas and Electric Company, Southern California Edison Company, and the Sacramento Municipal Utility District.
- For the Sacramento Municipal Utility District, he designed and drew the sample for a mail survey to collect data on the saturations of residential appliances.
- For the California Energy Commission, he was a primary contributor on a project to develop common sampling methodologies that utilities in California can use to conduct mail surveys of their residential and commercial customers.

Energy Technology Economics

Dr. Dohrmann also has conducted a number of studies in which the economic viability of new energy using technologies was assessed. These studies include:

- Preparing an analysis of the economics and market potential of producing hydrogen through coal gasification and through electrolysis.
- Estimating the market potential of newly developed solar cooling technologies.
- Analyzing the economic factors affecting the future equipment needs of electric utilities.
- Estimating the market potential for compressed air storage systems among electric utilities.
- Evaluating the market potential for repowering steam electric generating plants with gas turbines.

Energy Conservation & Load Management

Dr. Dohrmann has conducted several studies in which energy conservation and load management measures were analyzed and evaluated. Examples of the studies include:

- For the U.S. Department of Energy and the Electric Power Research Institute, he analyzed the impacts of time-of-day electricity rates on commercial and industrial firms. He was directly responsible for the design of the sampling methodology used to select 300 industrial and commercial firms for on-site interviews and for the design of the questionnaire used during the interview.
- For the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), he analyzed the costs of maintaining heating, ventilating and air conditioning equipment in office buildings. The data for this analysis were collected through a nationwide mail survey of office buildings that was conducted in conjunction with the Building Owners and Managers Association, International.
- For a major west cost utility, he analyzed the persistence of selected conservation measures among the utility's residential customers.
- For Lawrence Berkeley Laboratory, he conducted an econometric analysis to estimate fuel choice elasticities for the residential sector.
- For the State of Alaska, he evaluated the economics of energy efficiency performance standards for residential and commercial buildings in the state.

Demand Forecasting

Dr. Dohrmann has been a principal contributor on several projects to develop econometric/engineering models for forecasting the demand for electricity and natural gas in the commercial sector.

- For the Electric Power Research Institute, he prepared a report evaluating alternative methods for forecasting additions to the floorspace of different kinds of commercial buildings.

- For the Pacific Northwest Power Planning Council, he prepared an evaluation of different end-use models for forecasting energy use in the commercial and industrial sectors.
- For the California Municipal Utilities Association, he developed the specifications for simplified end-use forecasting models for the residential and commercial sectors.

Before becoming a Principal at ADM Associates, Inc., Dr. Dohrmann worked at Hittman Associates, Inc. and at the Research Center of United Technologies Corporation. He has taught economics at Yale University, the University of San Francisco, the University of Connecticut, and California State University, Sacramento.

Dr. Dohrmann graduated from Iowa State University with a B.S. in Economics. He received his M.A. and Ph.D. in Economics from Yale University.

Daniel W. Mort
Senior Associate

Mr. Mort is a Senior Associate and Senior Monitoring Specialist at ADM Associates, Inc. He is responsible for the design and implementation of end-use monitoring projects, including selection of monitoring and data-logging equipment, specification of data points, data verification and evaluation.

Residential Duct Testing and Repair

Mr. Mort was the project manager for four Duct Efficiency projects within California. The projects are with the four major utilities in California (*PG&E, SCE, SDG&E and SCG*) and is sponsored by the *California Board for Energy Efficiency.* Under this program, a set of state-of-the-art duct leakage testing procedures were developed, and over forty contractors were trained and equipped with the tools and procedures for residential duct repairs.

Residential End-Use Monitoring

Mr. Mort provided technical expertise to an indoor air quality study for the *California Energy Commission*. Blower door tests were conducted on 30 residences to measure indoor air infiltration rates. Another study for *Long Island Lighting Co.* made infiltration tests using blower doors to check the effects of adding weather stripping.

Mr. Mort provided technical expertise to short term residential air conditioning monitoring for *Central Power & Light.* 100 customers with rebated high-efficiency A/C units had monitoring equipment installed to collect one month of summer usage.

Electric Vehicle (EV) Monitoring

Mr. Mort is the principal investigator and technical expert on a project collecting data on Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV) for the *Department of Defense*. Long term data is being collected on the operation of two dozen vehicles in multiple fleets. We are developing performance characteristics of the EVs versus age and battery recharges. Also being studied are operating and maintenance costs, recharge times, range per charge, energy use, efficiency and user satisfaction. An automated data collection system provides extensive details of operation for each vehicle each time it is driven.

End-Use Monitoring of Industrial Facilities

Mr. Mort has been the project manager, or has provided technical expertise, for end-use monitoring projects of industrial facilities. He was extensively involved with the High efficiency Motor and Adjustable Speed Drive Evaluation project conducted for *Northern States Power*. This project metered 50 sites with HEMs and 50 sites with ASDs, most being industrial sites. Many industrial processes,

including injection molding machines, were monitored. Metering occurred after the new measures had been in place for one to two years. Additional time was used reconstructing the pre-retrofit conditions, so savings evaluations could be supported.

End-Use Monitoring of Commercial Buildings

Mr. Mort is the Project Manager for the End-Use Load Profile Monitoring of Commercial Buildings for *Southern California Edison* (SCE). On this project he has collected on-site information about the building electrical systems necessary to evaluate the end-uses to be monitored.

In a project for *San Diego Gas and Electric*, (SDG&E) Mr. Mort is in charge of the installation of monitoring equipment to judge chiller efficiency in commercial buildings. This involves preparing the metering plans, identifying the loads and equipment to be monitored, taking Btu measurements of the chilled water loops, and verifying the operation of the metering equipment.

End-Use Monitoring of Commercial Buildings

Detailed monitoring of end-uses in several grocery stores for *SCE* has been managed by Mr. Mort. Over 50 measurement points have been installed per site.

Mr. Mort was project manager for multiple commercial baseline end-use metering projects for *Entergy Services Inc*. Monitoring plans for each of a 100 commercial buildings were developed and submitted for approval prior to installation of the monitoring equipment. Long term data was collected on all the major end-uses at each site for electric and gas. The data was collected, validated and formatted to import into LodeStar.

Test Cell Monitoring

Mr. Mort has also worked as a consultant for the *Solar Energy Research Institute* (SERI) in Golden, Colorado. One of his responsibilities was the monitoring of a special test cell building. He performed the wiring installation and the data collection on the test cell. Another responsibility was the checking of data from certain Class B monitored sites. The Class B program was a national effort to collect monitored data on solar residential buildings.

Mr. Mort was a co-author of a report to the *Bonneville Power Administration*. The report discussed application results from the data collected on the CEC Solar Monitoring Project.

Mr. Mort is a graduate from California State University, Sacramento, with a Bachelors of Science degree in Physics. He received the Physics, Senior Achievement Award in 1982 before graduation. He is also a member of Sigma Pi Sigma, the National Physics Honor Society.